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MULTIMEDIA UNIVERSITY

STUDENT IDENTIFICATION NO

MULTIMEDIA UNIVERSITY

FINAL EXAMINATION

TRIMESTER 3, 2017/2018

BOM2064 – QUALITY AND OPERATIONS MANAGEMENT

(All Sections / Groups)

31 MAY 2018
2.30 p.m. – 4.30 p.m.
(2 Hours)

INSTRUCTIONS TO STUDENT

1. This Question paper consists of 7 pages with **FOUR** (4) questions only. Relevant equations and normal distribution tables are provided in the Appendix.

2. Answer **ALL** questions. The distribution of the marks for each question is given at the end of each question.

3. Please write all your answers in the answer booklet provided.

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QUESTION 1

a) Operations has major influence on competitiveness through many factors which are interrelated. Discuss any **FIVE (5)** aspects in which a business can compete using operations. Provide an example of a real-world company for each of the five aspects of competitiveness.

(10 marks)

b) A plant biologist assumes that there is a linear relationship between the amount of fertilizer supplied to strawberry plants and the subsequent yield of strawberries obtained. Eight strawberry plants, of the same variety, were selected at random and treated, weekly, with a solution in which X grams of fertilizer was dissolved in a fixed quantity of water. The yield, Y kilograms, of strawberries was recorded.

Plant	**A**	**B**	**C**	**D**	**E**	**F**	**G**	**H**
Fertilizer (grams)	1.0	1.5	2.0	2.5	3.0	3.5	4.0	4.5
Yield (kilograms)	3.9	4.4	5.8	6.6	7.0	7.1	7.3	7.7

i) Plot a scatter diagram of yield, Y, against amount of fertilizer, X.

(2 marks)

ii) Determine the linear regression equation for the data.

(9 marks)

iii) Calculate the correlation coefficient. Explain the relationship between these variables.

(2 marks)

iv) Predict the yield of a plant treated, weekly, with 3.2 grams of fertilizer.

(2 marks)

(Total: 25 marks)

QUESTION 2

a) Explain the concept of mass customization. What are the **TWO (2)** ways in which mass customization can be implemented? Support your answers with examples of companies.

(9 marks)

b) Computers are increasingly used for product design. Discuss **THREE** (3) benefits gained from Computer-Aided Design (CAD).

(6 marks)

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c) Explain the concept of six sigma. Provide **FOUR (4)** examples of companies which have adopted the six sigma program into their operations.

(6 marks)

d) Describe the lean six sigma process and give **TWO (2)** examples of companies who have implemented the lean six sigma approach in their daily operations.

(4 marks)

(Total: 25 marks)

QUESTION 3

a) Xebra Machines Sdn Bhd produces metal sheets, which are used as components for different kinds of machines. The critical measure is metal sheet hole's diameter, so that the component can be used for its designed purpose. Quality control has taken 10 samples during 10 days, each consisting of 5 sheets (measurements shown below).

Observation / Sample	1	2	3	4	5
Q	4.02	4.01	3.94	3.99	3.96
R	4.01	4.03	4.07	3.95	3.96
S	3.99	4.00	3.93	3.92	3.99
T	4.03	3.91	4.01	3.98	3.89
U	3.95	3.92	4.03	4.05	4.01
V	3.97	4.06	4.06	3.96	4.03
W	4.05	4.06	4.10	3.96	3.99
X	4.09	4.01	4.00	3.99	4.08
Y	4.14	4.10	3.99	4.08	4.09
Z	4.01	3.98	4.08	4.07	3.99

Calculate the control limits and determine if the process is in control.

(**Note**: Write your answers in nearest **TWO decimals**).

(15 marks)

b) Supply chain management involves coordinating activities across the supply chain. Discuss the **TEN (10)** key elements of supply chain management.

(10 marks)

(Total: 25 marks)

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QUESTION 4

a) Trinity Rose College uses an average of 50 boxes of copier paper a day. The college operates 280 days a year. Storage and handling costs for the paper are RM 35 a year per box, and it costs approximately RM 70 to order and receive a shipment of paper.

i) What is the economic order quantity?

(3 marks)

ii) Compute the total annual cost using your order size from part (i).

(3 marks)

iii) Except for rounding, are annual ordering and holding costs always equal at the EOQ?

(1 mark)

iv) How many orders of boxes of paper per year will there be?

(3 marks)

v) The office manager is currently using an order size of 200 boxes. The directors of the college expect the college to be managed in a cost-efficient manner. Would you recommend that the office manager use the optimal order size instead of 200 boxes? Justify your answer.

(5 marks)

b) Explain JIT and give **FOUR (4)** companies that use the JIT system.

(5 marks)

c) A factory manager wants to determine the number of containers to use for incoming parts for a kanban system to be installed next month. The process will have a usage rate of 70 pieces per hour. Because the process is new, the manager has assigned an inefficiency factor of 0.45. Each container can hold up to 55 pieces and it takes an average of 65 minutes to complete a cycle.

i) How many containers should be used?

(3 marks)

ii) Over time, as the system becomes better, will more or fewer containers be required? Explain your answer.

(2 marks)

(Total: 25 marks)

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RELEVANT EQUATIONS

1) CL = $\overline{\overline{X}}$, $\overline{R}$

UCL, LCL (X – bar) = $\overline{\overline{X}} \pm A_2 \overline{R}$

UCL (R) = $D_4 \overline{R}$

LCL (R) = $D_3 \overline{R}$

Table for X – bar & R Charts

No of Observation In sub group n	A2	D3	D4
2	1.88	0	3.27
3	1.02	0	2.57
4	0.73	0	2.28
5	0.58	0	2.11
6	0.48	0	2

2) UCL c = $\bar{c} + 3\sqrt{\bar{c}}$

LCL c = $\bar{c} - 3\sqrt{\bar{c}}$

3) $\bar{p}$ = Total No of Defective from All Samples/ (No of Samples X Sample Size)

$Sp = \sqrt{[\bar{p}(1 - \bar{p})/n]}$

CL = $\bar{p}$

LCL = $\bar{p} - 3\,Sp$

UCL = $\bar{p} + 3\,Sp$

4) Capacity Utilization = Capacity Used / Best Operating Level

5) $$r = \frac{n\sum XY - [\sum X \sum Y]}{\sqrt{\left[n\sum X^2 - (\sum X)^2\right]\left[n\sum Y^2 - (\sum Y)^2\right]}}$$

$$a = \overline{Y} - b\overline{X}$$

$$b = \frac{n\sum XY - \sum X \sum Y}{n\sum X^2 - (\sum X)^2}$$

Continued...

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6) Exponential smoothing

Forecast for the month t: $F_t = F_{t-1} + \alpha(A_{t-1} - F_{t-1})$

7) Inventory Management:

$$\text{EOQ} = Q^* = \sqrt{\frac{2DS}{H}} \qquad TC = \frac{Q}{2}H + \frac{D}{Q}S$$

$$\text{EPQ} = Q_0 = \sqrt{\frac{2DS}{H}}\sqrt{\frac{p}{p-u}} \qquad I_{\max} = \frac{Q}{P}(p-u) \qquad TC = \frac{I_{\max}}{2}\text{H} + \frac{\text{D}}{\text{Q}}\text{S}$$

$$SS = z\,(\sigma\text{d})\sqrt{LT} \qquad ROP = \bar{\text{d}}\,(LT) + z(\sigma\text{d})\sqrt{LT}$$

8) Lean Operations:

$$N = \frac{DT(1+X)}{C}$$

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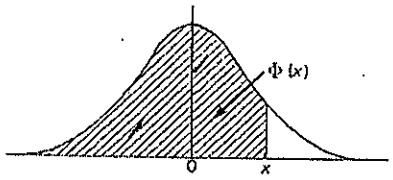
TABLE 4. THE NORMAL DISTRIBUTION FUNCTION

The function tabulated is $\Phi(x) = \frac{1}{\sqrt{2\pi}} \int_{-\infty}^{x} e^{-\frac{1}{2}t^2}\, dt$. $\Phi(x)$ is the probability that a random variable, normally distributed with zero mean and unit variance, will be less than or equal to x. When $x < 0$ use $\Phi(x) = 1 - \Phi(-x)$, as the normal distribution with zero mean and unit variance is symmetric about zero.



x	$\Phi(x)$	x	$\Phi(x)$	x	$\Phi(x)$	x	$\Phi(x)$	x	$\Phi(x)$	x	$\Phi(x)$
0·00	0·5000	0·40	0·6554	0·80	0·7881	1·20	0·8849	1·60	0·9452	2·00	0·97725
·01	·5040	·41	·6591	·81	·7910	·21	·8869	·61	·9463	·01	·97778
·02	·5080	·42	·6628	·82	·7939	·22	·8888	·62	·9474	·02	·97831
·03	·5120	·43	·6664	·83	·7967	·23	·8907	·63	·9484	·03	·97882
·04	·5160	·44	·6700	·84	·7995	·24	·8925	·64	·9495	·04	·97932
0·05	0·5199	0·45	0·6736	0·85	0·8023	1·25	0·8944	1·65	0·9505	2·05	0·97982
·06	·5239	·46	·6772	·86	·8051	·26	·8962	·66	·9515	·06	·98030
·07	·5279	·47	·6808	·87	·8078	·27	·8980	·67	·9525	·07	·98077
·08	·5319	·48	·6844	·88	·8106	·28	·8997	·68	·9535	·08	·98124
·09	·5359	·49	·6879	·89	·8133	·29	·9015	·69	·9545	·09	·98169
0·10	0·5398	0·50	0·6915	0·90	0·8159	1·30	0·9032	1·70	0·9554	2·10	0·98214
·11	·5438	·51	·6950	·91	·8186	·31	·9049	·71	·9564	·11	·98257
·12	·5478	·52	·6985	·92	·8212	·32	·9066	·72	·9573	·12	·98300
·13	·5517	·53	·7019	·93	·8238	·33	·9082	·73	·9582	·13	·98341
·14	·5557	·54	·7054	·94	·8264	·34	·9099	·74	·9591	·14	·98382
0·15	0·5596	0·55	0·7088	0·95	0·8289	1·35	0·9115	1·75	0·9599	2·15	0·98422
·16	·5636	·56	·7123	·96	·8315	·36	·9131	·76	·9608	·16	·98461
·17	·5675	·57	·7157	·97	·8340	·37	·9147	·77	·9616	·17	·98500
·18	·5714	·58	·7190	·98	·8365	·38	·9162	·78	·9625	·18	·98537
·19	·5753	·59	·7224	·99	·8389	·39	·9177	·79	·9633	·19	·98574
0·20	0·5793	0·60	0·7257	1·00	0·8413	1·40	0·9192	1·80	0·9641	2·20	0·98610
·21	·5832	·61	·7291	·01	·8438	·41	·9207	·81	·9649	·21	·98645
·22	·5871	·62	·7324	·02	·8461	·42	·9222	·82	·9656	·22	·98679
·23	·5910	·63	·7357	·03	·8485	·43	·9236	·83	·9664	·23	·98713
·24	·5948	·64	·7389	·04	·8508	·44	·9251	·84	·9671	·24	·98745
0·25	0·5987	0·65	0·7422	1·05	0·8531	1·45	0·9265	1·85	0·9678	2·25	0·98778
·26	·6026	·66	·7454	·06	·8554	·46	·9279	·86	·9686	·26	·98809
·27	·6064	·67	·7486	·07	·8577	·47	·9292	·87	·9693	·27	·98840
·28	·6103	·68	·7517	·08	·8599	·48	·9306	·88	·9699	·28	·98870
·29	·6141	·69	·7549	·09	·8621	·49	·9319	·89	·9706	·29	·98899
0·30	0·6179	0·70	0·7580	1·10	0·8643	1·50	0·9332	1·90	0·9713	2·30	0·98928
·31	·6217	·71	·7611	·11	·8665	·51	·9345	·91	·9719	·31	·98956
·32	·6255	·72	·7642	·12	·8686	·52	·9357	·92	·9726	·32	·98983
·33	·6293	·73	·7673	·13	·8708	·53	·9370	·93	·9732	·33	·99010
·34	·6331	·74	·7704	·14	·8729	·54	·9382	·94	·9738	·34	·99036
0·35	0·6368	0·75	0·7734	1·15	0·8749	1·55	0·9394	1·95	0·9744	2·35	0·99061
·36	·6406	·76	·7764	·16	·8770	·56	·9406	·96	·9750	·36	·99086
·37	·6443	·77	·7794	·17	·8790	·57	·9418	·97	·9756	·37	·99111
·38	·6480	·78	·7823	·18	·8810	·58	·9429	·98	·9761	·38	·99134
·39	·6517	·79	·7852	·19	·8830	·59	·9441	·99	·9767	·39	·99158
0·40	0·6554	0·80	0·7881	1·20	0·8849	1·60	0·9452	2·00	0·9772	2·40	0·99180

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TABLE 4. THE NORMAL DISTRIBUTION FUNCTION

x	$\Phi(x)$	x	$\Phi(x)$	x	$\Phi(x)$	x	$\Phi(x)$	x	$\Phi(x)$	x	$\Phi(x)$
2·40	0·99180	2·55	0·99461	2·70	0·99653	2·85	0·99781	3·00	0·99865	3·15	0·99918
·41	·99202	·56	·99477	·71	·99664	·86	·99788	·01	·99869	·16	·99921
·42	·99224	·57	·99492	·72	·99674	·87	·99795	·02	·99874	·17	·99924
·43	·99245	·58	·99506	·73	·99683	·88	·99801	·03	·99878	·18	·99926
·44	·99266	·59	·99520	·74	·99693	·89	·99807	·04	·99882	·19	·99929
2·45	0·99286	2·60	0·99534	2·75	0·99702	2·90	0·99813	3·05	0·99886	3·20	0·99931
·46	·99305	·61	·99547	·76	·99711	·91	·99819	·06	·99889	·21	·99934
·47	·99324	·62	·99560	·77	·99720	·92	·99825	·07	·99893	·22	·99936
·48	·99343	·63	·99573	·78	·99728	·93	·99831	·08	·99896	·23	·99938
·49	·99361	·64	·99585	·79	·99736	·94	·99836	·09	·99900	·24	·99940
2·50	0·99379	2·65	0·99598	2·80	0·99744	2·95	0·99841	3·10	0·99903	3·25	0·99942
·51	·99396	·66	·99609	·81	·99752	·96	·99846	·11	·99906	·26	·99944
·52	·99413	·67	·99621	·82	·99760	·97	·99851	·12	·99910	·27	·99946
·53	·99430	·68	·99632	·83	·99767	·98	·99856	·13	·99913	·28	·99948
·54	·99446	·69	·99643	·84	·99774	·99	·99861	·14	·99916	·29	·99950
2·55	0·99461	2·70	0·99653	2·85	0·99781	3·00	0·99865	3·15	0·99918	3·30	0·99952

The critical table below gives on the left the range of values of x for which $\Phi(x)$ takes the value on the right, correct to the last figure given; in critical cases, take the upper of the two values of $\Phi(x)$ indicated.

3·075	0·9990	3·263	0·9994	3·731	0·99990	3·916	0·99995
3·105	0·9991	3·320	0·9995	3·759	0·99991	3·976	0·99996
3·138	0·9992	3·389	0·9996	3·791	0·99992	4·055	0·99997
3·174	0·9993	3·480	0·9997	3·826	0·99993	4·173	0·99998
3·215	0·9994	3·615	0·9998	3·867	0·99994	4·417	0·99999
			0·9999		0·99995		1·00000

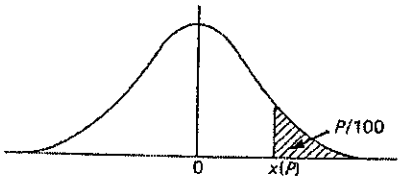
When $x > 3{\cdot}3$ the formula $1-\Phi(x) \doteqdot \frac{e^{-\frac{1}{2}x^2}}{x\sqrt{2\pi}}\left[1-\frac{1}{x^2}+\frac{3}{x^4}-\frac{15}{x^6}+\frac{105}{x^8}-\ldots\right]$ is very accurate, with relative error less than $945/x^{10}$.

TABLE 5. PERCENTAGE POINTS OF THE NORMAL DISTRIBUTION

This table gives percentage points $x(P)$ defined by the equation

$$\frac{P}{100} = \frac{1}{\sqrt{2\pi}}\int_{x(P)}^{\infty} e^{-\frac{1}{2}t^2}\,dt.$$

If X is a variable, normally distributed with zero mean and unit variance, $P/100$ is the probability that $X \geqslant x(P)$. The lower P per cent points are given by symmetry as $-x(P)$, and the probability that $|X| \geqslant x(P)$ is $2P/100$.



P	$x(P)$	P	$x(P)$	P	$x(P)$	P	$x(P)$	P	$x(P)$	P	$x(P)$
50	0·0000	5·0	1·6449	3·0	1·8808	2·0	2·0537	1·0	2·3263	0·10	3·0902
45	0·1257	4·8	1·6646	2·9	1·8957	1·9	2·0749	0·9	2·3656	0·09	3·1214
40	0·2533	4·6	1·6849	2·8	1·9110	1·8	2·0969	0·8	2·4089	0·08	3·1559
35	0·3853	4·4	1·7060	2·7	1·9268	1·7	2·1201	0·7	2·4573	0·07	3·1947
30	0·5244	4·2	1·7279	2·6	1·9431	1·6	2·1444	0·6	2·5121	0·06	3·2389
25	0·6745	4·0	1·7507	2·5	1·9600	1·5	2·1701	0·5	2·5758	0·05	3·2905
20	0·8416	3·8	1·7744	2·4	1·9774	1·4	2·1973	0·4	2·6521	0·01	3·7190
15	1·0364	3·6	1·7991	2·3	1·9954	1·3	2·2262	0·3	2·7478	0·005	3·8906
10	1·2816	3·4	1·8250	2·2	2·0141	1·2	2·2571	0·2	2·8782	0·001	4·2649
5	1·6449	3·2	1·8522	2·1	2·0335	1·1	2·2904	0·1	3·0902	0·0005	4·4172

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